Highlights of Nanoscale Science and Technology at UB

UB Led Multi-institutional Initiatives:

Polymeric Nanophotonics and Nanoelectronics: AFOSR Defense University Research Initiative on Nanotechnology (DURINT)

Spintronics and Spinphotonics in FM InAs/GaSbbased Hereterostructures: DARPA SpinS Program

Local Resources:

ILPB: 25 faculty members active in nano/bio photonics

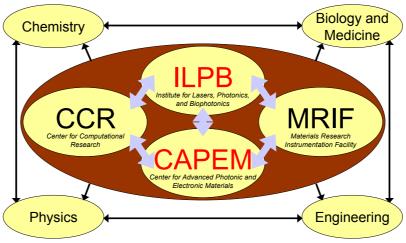
CAPEM: 27 faculty members active in materials research

MRIF: manages and maintains shared research instruments

CCR: provides computational tools for nanoscale modeling and simulation

Associated faculty funded by: NIH, NSF, DOE, ONR, AFOSR, ARO, NASA

Existing Infrastructure



Experimental Capabilities

Collaborations:

National Laboratories:

NRL, AFRL, ARL, NASA GRC, NIST, Sandia Industrial:

Intel, GE, Micron, Corning, Kodak, Anvik, and others Universities:

MIT, Yale, UC Berkeley, Washington, Cornell, RIT, CCNY, Georgia Tech, Notre Dame, Penn State, and others International:

Chitose Institute of Science and Technology (Japan), Atlantic Corridor, Industrial Technology Research Institute (Taiwan), Australian Photonics Cooperative Research Center, State Key Laboratory Nanocenter (China), and others

Student Education and Training:

NSF Biophotonics Integrative Graduate Education and Research Traineeship (IGERT)

Synthesis and Growth

MBE and MOCVD Sol-gel processing Vapor-phase, Liquid-phase, and Two-phase nanoparticle synthesis systems **Bioinspired and Hybrid materials Surfactant and Block-copolymer**

based self-assembly



Structural Characterization

Magnetic Field Facilities

SQUID magnetometry Optical access 10T split-coil magnet 15T/17T magnet for visible (fiber optic), FIR and transport measurements

> CdTe dots on a ZnTe surface after annealing



Recently Acquired Equipment

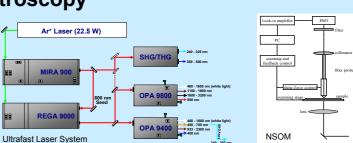
Fiber Drawing Tower E-Beam Lithography

Spectroscopy

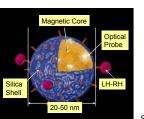
PL and PLE FTIR and FIR lasers, ODR **Raman Scattering Reflection and Transmission** Time-Resolved PL and pulsed THz **Ultrafast pump-probe**

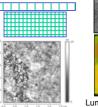
Microscopy

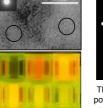
Confocal microscopy Two-photon microscopy **Near Field Scanning Optical Microscopy (NSOM) Laser Trapping**



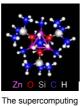
Photonic or electronic building blocks DNA Building Blocks for Ordered Nanostructures





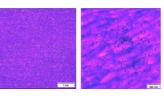


Self-Organized Quantum Top: TEM Image
Nanoclinic for Biomedical Applications Dots produced by MBE Bottom: PL (UV excitation)

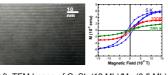


power of CCR permits to be performed on

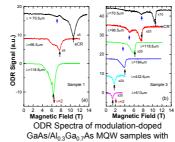
Representative Results



MFM Images of GaSb (18 ML)/Mn (0.5 ML) before (left) and after annealing (5 min at 500°C). Ferromagnetic MnSb clusters in NiAs structure are formed



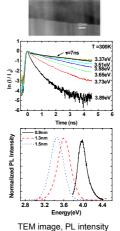
Left: TEM Image of GaSb (12 ML)/Mn (0.5 ML) grown by MBE. Right: Room temperature SQUID measurements on the sample at left



nominal donor (Si) doping levels of (a) 3.2 x 10¹¹ cm⁻² and (b) 0.8 x 10¹¹ cm⁻²

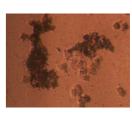


dispersed liquid crystal nano-composite

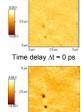


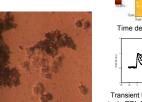
spectra of GaN/AIN MQW heterostructures grown by





Selective binding of monodispersed red nanophosphors to oral epithelial cancer cells. Top PL under 974 nm excitation Bottom: Combined fluorescence and transmission images







Transient Transmission

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